In the Drawings

The attached three sheets of drawings include new Figs. 3(a)' to 3(c)' and Figs. 5(a) to 5(r)'.

Attachment: Three (3) New Sheets

REMARKS/ARGUMENTS

Favorable reconsideration of this application as currently amended and in view of the following remarks is respectfully requested.

Claims 1-8, 13-21, 23, 24, 26-29, and 39 are presently active in this case. Claim 1 has been amended by the present amendment. New Figures 3(a)' to 3(c)' and 5(a)' to 5(r)' have been added. Those figures reflect the preferred location for inserting the cc-layers. The locations are extracted from corresponding Figures 3(a) to 3(c) and 5(a) to 5(r). No new matter has been added.

In the outstanding office action, Claims 1-8 and 39 were rejected under 35 USC 102(e) as being anticipated by Sakakima et al. (5,715,121); Claims 13, 15, 19, 21, 23, and 28 were rejected under 35 USC 103(a) as being unpatentable over Sakakima et al. in view of Carey et al. (6,686,068); claim 16 was rejected under 35 USC 103(a) as being unpatentable over Sakakima et al. in view of "AAPA" (Applicant's Admitted Prior Art); claims 14, 20, 24, and 29 were rejected under 35 USC 103(a) as being unpatentable over Sakakima et al. in view of Carey et al. and Kamijo (6,819,532); claims 17 and 18 were rejected under 35 USC 103(a) as being unpatentable over Sakakima et al. in view of AAPA; and claims 26 and 27 were rejected under 35 USC 103(a) as being unpatentable over Sakakima et al. in view of Carey et al. and AAPA.

Briefly recapitulating, the present invention (Claim 1 as amended) is directed to a CPP spin-valve element including a free layer structure; a pinned layer structure; a thin non-magnetic spacer layer structure; and at least two current-confining layer structures. Each of the at least two current-confining layer structures is located on a different side of the thin non-magnetic spacer layer. The present invention is based on the finding that a huge enhancement of the CC-Layer effect can be obtained through properly locating the CC-layers as is seen in Fig. 5 (a) through Fig. 5 (r) which show how the GMR effect depends on the

location of the two CC-layers when the pinned layer structure includes a ferromagnetic layer and an anti-ferromagnetic layer with the latter being located farther from the nonmagnetic conducting layer than the ferromagnetic layer. In these figures, the obtainable GMR ratio is shown by the darkened area divided into 8 levels. It is clearly seen that, depending on the relative location of the two CC-layers, the GMR ratio changes drastically demonstrating that the greatest GMR ratio is obtained when the CC-layers are located on opposite sides of the nonmagnetic conducting layer set between the free- and pinned-layers.

The present invention (Claim 19) is also directed to a CPP spin valve element including a free layer structure; a pinned layer structure; and a thin non-magnetic current confining layer structure. The width of the confined current paths of the current confining layer structure is greater than $t^{3/2}$ where t is the thickness of at least one of the free layer structure and the pinned layer measured in a nanometers.

Likewise, Claim 28 defines a configuration including at least one current confining layer structure where the width of at least one of the confined current paths is the same width defined by Claim 19.

Lastly, Claim 21 is directed to a CPP spin valve element including a free layer structure; a pinned layer structure; a first thin non-magnetic current confining layer structure; and a second current confining layer structure placed across at least one of the free layer and the pinned layer. The conducting parts of the CC layers are located in a cascade manner and at least an inner edge to edge distance of a projection of the conducting parts of the CC layers forming at least one of the current paths through the free layer structure or the pinned layers onto the layer plane is made greater than a thickness of at least one of the free layer structure and the pinned layer. This configuration facilitates obtaining a high magnetoresistance.

In contrast thereto, the Sakakima et al. patent is directed to a unit GMR element composed of two ferromagnetic layers including a free and a pinned layer with a CC-layer in

between. As discussed above, in the present invention, the unit element includes two ferromagnetic layer structures including a free layer structure and a pinned layer structure with a nonmagnetic conducting layer in between with two CC-layers located on different sides of the non-magnetic conducting layer. In the case of Sakakima et al., the plurality of C-layers is realized when a plurality of the unit elements are combined into one. Further, Fig. 5 of Sakakima et al. illustrate that the anti-ferromagnetic layer 4 is located closer to the nonmagnetic conducting layer separating the free layer 1 and pinned layer 3' than the ferromagnetic layer. Consequently, Sakakima et al. are not believed to anticipate Claim 1 as amended and the 35 U.S.C. § 102(e) rejection should be withdrawn.

Regarding Claims 19, 21, and 28, the official action asserts that that Carry et al. remedy the deficiency of Sakakima et al. In particular, the official action asserts that Carry et al. teach a configuration where the width of the confined current paths of said CC-layer structure is greater than $t^{3/2}$ where t is the thickness of at least one of the free layer structure and the pinned layer measured in nano-meters. Applicants respectfully traverse. Applicants point out that what the official action identifies as the size of the CC path is true if there is only one CC path in an element of 500 A x 500 A and the metal grains grew a pillar with the same size from the bottom to the top. However, what affects the current confinement most is the size of the pillar contacting directly to the ferromagnetic layer. Therefore, the effective size of the pillar of such a metallic grain may be much smaller than the estimated value in the office action, as is shown schematically in Fig. 2 ~ Figs. 5 of Carry et al.

Applicants further point out that it is difficult to grow such a large metal pillar in a heterogeneous layer of a thickness within the scope of the present invention (typically, in the range of nm: See Table 1 of the present application, for instance) by means of ordinary deposition methods as is detailed in the Carry et al. specification ("These heterogeneous spacer layers can typically have metallic grains with sizes between about 20 and about 80 A,

which are suitable sizes for the application ....") See col. 7, lines 16-20 of US 6,686,068. Consequently, Sakakima et al. are not believed to anticipate or render obvious the subject matter defined by Claims 19, 21, and 28 even when considered in combination with Carry et al.

In view of the present amendment, no further issues are believed to be outstanding in the present application, and the present application is believed to be in condition for formal allowance. An early and favorable action is therefore requested.

Respectfully submitted,

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